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Mitigation of Covid- 19 with Immunity Through the Diverse Indian Food Systems

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Abstract: Medicinal herbs can help the people to boost their immunity system during the outbreak of Covid-19. Plants are rich in alkaloids, flavonoids, terpenoids, glycosides, lactones, vitamin C, or the carotenoids and hence can increase the immune function. Medicinal herbs may be helpful for boosting the immune system which maintains homeostasis by defending against viruses and bacteria which can cause inflammation in the body, illness and diseases. According to the Unani and Ayurvedic systems of medicine as practised in India, certain medicinal herbal extract has antimicrobial activity against many genera of bacteria, fungi and viruses which also helps to boost the immune system. Nutritional deficiencies can impair the immune function, and increase both the risk and severity of the infection. So it is needless to say that there is a correlation between medicinal plants, immune system, antiviral properties and Covid-19. Effort has been made to shortlist the Indian medicinal herbs which posses antiviral properties and can be used towards inhibiting the growth of the virus and hence boosts immunity and fight against the foreign pathogens.

Introduction

Severe Acute Respiratory Syndrome (SARS) due to zoonotic Coronavirus SARS-CoV was reported for the first time in the year 2002 in the Guangdong Province of Southern China. This was followed by Middle East Respiratory Syndrome (MERS-CoV), due to Coronavirus with similar characteristics which appeared in Saudi Arabia after 10 years in 2012. Both these episodes caused severe pneumonia, leading to large-scale mortality as also economic losses. Recently in 2019, the history of pandemic repeated with Covid-19Coronavirus disease due to a new zoonotic Coronavirus (SARS-CoV-2) at Wuhan, Hubei Province, China (Carlo Contini *et al*., 2020). The study revealed the significant genomic similarities of 2019 - nCoV with the earlier pandemic Severe Acute Respiratory Syndrome (SARS) of 2002 (Shajeea Arshad Ali *et al*., 2019) and the host for the virus SARS-CoV-2 and β-Coronavirus has been wild animals. SARS-CoV is similar to Covid-19 novel Coronavirus, which make use of similar receptor, Angiotensin-Converting Enzyme 2 (ACE2) and mainly spreads through the respiratory tract (Yan-Rong Guo *et al*., 2020) with symptoms such as dry cough, fever and chest pain with

pneumonia. It is noteworthy that biodiversity-rich regions (for example Western Ghats) had lesser instances of the disease compared to other parts of the country, which highlights that the diet plays a decisive role in providing immunity in addition to social distancing and proper hygiene. Exploratory survey in the villages of Western Ghats highlighted the negative correlation between Covid-19 and the ecosystem services and positive correlation of GHG footprint with Covid-19 spread. Increasing body's immunity with a well-balanced diet of diverse natural products would help in mitigating the spread of the disease. Good health in humans requires better immunity, which is possible through a balanced diet for being physically and mentally active. In this pandemic situation a well-balanced diet and dietary intake of diverse nutrients is an appreciable and favourable concern on immune system through cell activation, modification of signalling molecules and gene expression. Additionally, the gut microbial composition improvements with the food ingredients develop the immune system in the body. A proper diet of natural products provides immuno-modulatory, antiviral and anti-inflammatory effects boosting the immune system.

The major dietary compounds such as Vitamin A, C, D, E and zinc possess immuno-modulatory properties. Vitamin A is known for its therapeutic effects for the curing of various infectious diseases (Zhiyi Huang *et al*., 2018) due to improvements in the immune system with the regulatory roles in humoral immune processes and cellular immune responses. The immune cells such as B cells, T cells and antigen synthesize active Vitamin D metabolite (as Vit D receptor is expressed on these cells) harmonizing the adaptive and innate immune response (Cynthia Aranow, 2011).

Vitamin C is an essential nutrient to boost immunity and has potent antioxidant activity that decreases inflammation. Vitamin C is being used widely in severe respiratory illness and associated lung inflammation due to viral infection. Zinc plays a key role in the inflammatory response and is essential for immune cell development and communication. The zinc deficiency causes considerable malfunction of immune system which in-turn increases the risk of infection and disease including pneumonia.Vitamin B (including B12 and B6) helps in the proper functioning of various immune cells enhancing their ability to protect against infection (https://www.healthline.com/nutrition/vitamin-c-coronavirus#vitamin-c-immunity).

Recently Indian Drug Regulatory Authority has accorded confirmation based on its safety and efficacy towards vaccination of Covid-19 by COVISHIELD (Local name), developed by Oxford-Astra Zeneca, manufactured locally by Serum Institute, India and COVAXIN an indigenous vaccine developed by Bharat Biotech Ltd. The vaccination program started on 16th January, 2021 and similar exercise is in progress globally by different developers like

Moderna,Pfizer, BioNTech, Gamaleya (Sputnic V), etc.

The traditional use of medicinal plants containing bioactive compounds has been the key factor towards enhancing the body's immunity. As per the World Health Organisation (WHO, 2001), herbal medicines have been catering to the health needs of about 80% of the world population. It is also indicated that the usage of medicinal plants for primary healthcare is occupying a prominent position in developing countries (WHO, 2002; Singh *et al*., 2014). The herbal medicines are very effective, cheaply available, apparently have no side effects and used as an alternative to allopathic medicines.

Phytochemical compounds of plants have wide range of pharmacological use. It is, therefore, becomes pertinent to study the phytochemical potential of diverse native plants, and innovative techniques that guarantee firm immune system of our body. This article explores the potentiality of natural plants towards deriving a safe and effective medicine to enhance immuno-modulatory and anti-viral properties due to the presence of flavonoids, phenolics, carotenoids, limonin, vitamin and essential oil products. Table 1 lists the selected common herbs and spices, its uses and the biochemical constituents.

Conclusion

Analyses of field data of food habits reveals that those using native plant species in the daily diet had acquired immunity against Covid-19, as evident from the lower instances of infections in regions dominated by diverse native species. Native plants containing biochemical constituents of bioactive compounds, vitamins, minerals and antioxidants have helped in boosting the immune system. These common herbs and spices have benefits such as low cost, minimum toxicity and are almost found everywhere in the country, with the potential immunity against Covid-19 and other infectious diseases. This emphasizes the role of the ecosystem in providing diverse food and medicine to the dependent biota. Naturally derived medicines aid as an alternative of allopathic i.e. safe and without side effect to fight against viral infection and helps to increase immunity.

References

Anjula Pandey, Pradheep, K. and Rita Gupta (2011) - Drumstick tree (*Moringa oleifera* Lam.): A multipurpose potential species in India, *Genetic Res. & Crop Evol.*, **58:** 453–460.

Carlo Contini, Mariachiara Di Nuzzo, Nicole Barp (2020) - The novel zoonotic Covid- 19 pandemic: An expected global health concern. *J. Infect. Dev. Countries,***14(3):** 254-264.

Cynthia Aranow (2011) - Vitamin D and the immune system, *J. Investig. Med*., **59(6):** 881–886.

De Clercq, E. (2000) - Current lead natural products for the chemotherapy of human immuno-deficiency virus (HIV) infection, *Med. Res. Rev.,* **20:** 323–349.

De Simone, F., Aquino, R. and De Tommasi, N. (2001) - Anti-HIV aromatic compounds from higher plants. In: Bioactive Compounds from Natural Sources: Isolation, Characterization and Biological Properties. Taylor and Francis; New York, NY, USA, 325p.

Geone M. Correa, Antonio F. and de C. Alcantara (2012) - Chemical constituents and biological activities of species of Justicia - A review, *Rev. Bras. Farmacogn,* **22(1):** 220-238.

Giuseppe Gattuso, Davide Barreca and Claudia Gargiulli (2007) - Flavonoid composition of *citrus* juices.*Molecules*, **12(8):** 1641–1673.

https://www.healthline.com/nutrition/vitamin-c-coronavirus#vitamin-c-immunity

Leila Gorgani (2016) - Piperine: The bioactive compound of Black pepper: From isolation to medicinal formulations: Piperine isolation from pepper. *Comprehensive Rev. Food Sci. & Food Safety*, **16(1):** 124-140.

Meena Vangalapati, Sree Satya, N. and Surya Prakash, D.V.(2012) - A review on pharmacological activities andclinical effects of Cinnamon species, *Res. J. Pharma., Biol. & Chem. Sci.,* **3(1):** 653.

Mi-Ichi, F., Miyadera, H., Kobayashi, T., Takamiya,S.and Waki, S. (2005) - Parasite mitochondria as a target of chemotherapy: Inhibitory effect of licochalcone A on the *Plasmodium falciparum* respiratory chain, *Annals. N.Y. Acad. Sci.*,**1056:** 46–54.

Mohamed Atef Nasr-Eldin, Ahmed Abdelhamid and Dina Baraka (2017) - Antibiofilm and antiviral potential of leaf extracts from *Moringa oleifera* and Rosemary (*Rosmarinus officinalis* Lam), *Egypt. J. Microbiol*, **52:** 129–139.

Pranoti Belapurkar, Pragya Goyal and Preeti Tiwari-Barua (2014) - Immuno-modulatory effects of triphala and its individual constituents: A review, *Indian J. Pharm. Sci.*, **76(6):** 467-475.

Raimunda Samia Nogueira Brilhante, Jamille Alencar Sales and Vandbergue Santos Pereira (2017) - Research advances on the multiple uses of *Moringa oleifera*: A sustainable alternative for socially neglected population,*Asian Pacific J. Trop. Med*., **10(7):** 621-630. .

Rajandeep Kaur, Harpreet Kaur and Ajaib Singh Dhindsa (2013) - *Glycyrrhiza glabra*: A phytopharmacological review, *Intl J. Pharma.Sci. & Res.*, **4(7):** 2470-2477.

Rakesh Kumar Joshi (2017) - Phytoconstituents, traditional, medicinal and bioactive uses of Tulsi (*Ocimum sanctum* Linn.): A review, *J. Pharmacog. & Phytochem*.,**6(2):** 261-264.

Sampath Kumar, K.P. and Debjit Bhowmik Chiranjib (2010) - Indian traditional herbs: *Adhatoda vasica* and its medicinal applications, *J. Chem. Pharm. Res*., **2(1):** 240-245.

Shajeea Arshad Ali, Mariam Baloch and Naseem Ahmed (2020) - The outbreak of Coronavirus disease 2019 (Covid-19) - An emerging global health threat, *J. Infection & Public Health,* **13(4):** 644-646.

Singh H., Husain, T., Agnihotri, P., Pande, P.C. and Khatoon, S. (2014) - An ethnobotanical study of medicinal plants used in sacred groves of Kumaon Himalaya, Uttarakhand, India, *J. Ethnopharmacol.*, **154(1):** 98-108.

Singh, P., Srivastava, S. and Singh, V.B. (2018) - Ginger (*Zingiber officinale*): A novel herbal remedy, *Intl. J. Curr. Microbiol. App. Sci., Special Issue* -7: 4065-4077.

Sulekha Gotmare and Eshe Tambe (2019) - Identification of chemical constituents of Cinnamon bark oil by GCMS andcomparative study garnered from five different countries., *Global J.Sci.,Frontier Res.: C Biol. Sci.,* 19 (1 Version).

WHO (2001) - Legal Status of Traditional Medicine and Complementary/ Alternativemedicine: A world wide review. WHO Publcations

WHO (2002) - Traditional Medicine Strategy 2002-2005. WHO Publications.

Yan-Rong Guo, Qing-Dong Cao and Zhong-Si Hong (2020) - The origin, transmission and clinical therapies on Coronavirus disease 2019 (Covid-19) outbreak – an update on the status. *Military Med. Res.*, 7: 11.

Zhiyi Huang,Yu Liu and Guangying Qi (2018) - Role of Vitamin A in the immune system, *J. Clin. Med.,***7(9):** 258.

Zorica Stojanovi´c-Radi´c, Milica Pejıci´c and Marina Dimitrijev (2019) - Piperine-A major principle of black pepper: A review of its bioactivity and studies, *Appl. Sci*., **9:** 4270.

Table 1. Herbs and spices with bioactive compounds

Plant	Uses	Bioactive constituents
Glycyrrhiza glabra (Common name: Licorice, Hindi: Jethi-madh,Kannada: Jestamadhu, Bengali: Jasthi Madhu). *Glycyrrhiza glabra* belongs to the family Fabaceae, commonly known as Licorice or sweetwood or Mulaithi. It is a herbaceous perennial and native species of Asia and Europe. 	It has been widely used as a flavoring agent in foods and medicinal remedies for thousands of years. Bioactive compounds are useful in immuno-modulatory functions and antimicrobial activities. Useful in treating Malaria, Herpes simplex, Human cytomegalovirus, Epstein–Barr, Influenza, Hepatitis A, B, and C, HIV, Varicella zoster, and Severe Acute Respiratory Syndrome (SARS) Coronavirus. It has been traditionally used in Ayurveda for curing of respiratory problem (such as cough, sore throat, respiratory tract infections like asthma and bronchitis).	The bioactive compound Glycyrrhizin, is a saponin consisting of triterpenoid aglycone, Glycyrrhetic acid (Glycyrrhetinic acid; enoxolone) conjugated to a disaccharide of glucuronic acid. Flavonoids include liquirtin, isoliquertin liquiritigenin, rhamnoliquirilin and five new flavonoids glucoliquiritin apioside, prenyllicoflavone-A, shinflavanone, shinpterocarpin and 1-methoxyphaseolin (Rajandeep Kaur *et al*., 2013; De Simone *et al*., 2001; De Clercq *et al*., 2000; Mi-Ichi *et al*., 2005).
Justicia adhatoda (Common Name: Malabar nut, Hindi: Arusa, Kannada: Aadusoga, Bengali: Basak) *Justicia adhatoda* (synonym *Adhatoda vasica*) is a shrub which belongs to family Acanthaceae. 	The plant is used by Asian and European medical practitioners.The alkaloid, which has been named vasicinone and vasicine is proved to have a broncho-constricting action and broncho-dilator effects. 6H-Quinindoline also shows same properties. The Anisotine and Vasicoline of *J. adhatoda* are very good inhibitors. Other alkaloids named Vasicinol and Kaempferitrin aid in antimicro-bial activities and are useful for influenza virus, cold and cough.*J. adhatoda* juice and root bark are used for curing of the respiratory tract.	The alkaloids are Vasicine, Vasicinone, Anisotine. Other constituents are lignans, two other alkaloids (Vasicinol and 6H-Quinindoline), coumarin, flavonoids (Kaempferitrin)and terpenoids (iridods, diterpenoids, and triterpenoids). Also present are compounds like vitamin C, carotene and an essential oil (Geone *et al*., 2011; Sampath Kumar *et al*., 2010).

Plant	Uses	Bioactive constituents
Moringa oleifera (Common name: Drumstick tree, Hindi: Senjana, Kannada: Nugge, Bengali: Sajna). *Moringa oleifera*, a medium sized tree species, commonly known as 'drumstick tree' or 'horseradish tree' belongs to the Family Moringaceae. It is found in dry and hot climates of north-western plains, central India and dry regions of peninsular India (Anjula Pandey *et al*., 2011). 	It is widely used as traditional medicine to cure asthma and diarrhea. The chemical compound of this plant such as 4-α-L-rhamnopyranosyloxy-benzylglucosinolate, 4-(α-L-rhamnosyloxy-benzyl) isocyanate, Niazimicin, Niazinin and Quercetin have immuno-modulatory activities followed by Niaziminin and isocynate as antiviral properties. Roots and leaves are useful to cure cold, cough and fever.	The chemical constituents in *M. oleifera* are β-carotene, phytyl fatty acid ester, polyprenol, chlorophyll A, β-sitosterol, triacylglycerols, benzo-γ-pyrone, isocynate, Quercetin, *N*, α-L-rhamnopyranosyl vincosamide, phenylacetonitrile pyrrolemarumine, 4-α-L-rhamnopyranosyloxy-benzylglucosinolate, 4-(α-L-rhamnosyloxy-benzyl) isocyanate, Niaziminin, Niazimicin, Niazinin and its glucopyranosyl derivative fatty acids, fatty alcohols, and saturated hydrocarbons. Nutritional qualities of *Moringa* includes Vitamin C, iron, Vitamin A, calcium, potassium, etc. (Mohamed Atef Nasr-Eldin *et al*., 2017; Raimunda Samia Nogueira Brilhante *et al*., 2017).
Citrus limon (Common name: Lemon, Hindi: Nimbu, Kannada: Madala, Bengali: Lebu) Citrus plants are shrubs or small trees having evergreen characteristics and grows in sub-tropical, tropical, and temperate regions, and are most widely cultivated trees. Citrus belong to the Family Rutaceae which includes Oranges, Mandarins, Tangerines, Limes, Grapefruits, Lemons, and Citrons.	In Asia, it is known as *Citrus limon*, which has yellow ellipsoidal fruits and has notable nutritional and medicinal properties. The biological activities includes antimicrobial activities such as Naringenin, essential oils, Kaempferol, Quercitin, Apigenin etc. The fruit is rich in Vitamin C and it helps to cure cold and cough. According to Ayurveda, citrus leaf oil reduces headache.	The chemical constituents in citrus are Naringenin, essential oils, Kaempferol, Quercitin, Apigeni,7-hydroxy-3, 4-flavone, ethyl gallate, galloyl glucose, chebulaginic acid, phenyllemblin, β-sitosterol, anthraquinones, glycosides such as bellaricanin and other carbohydrates. The oil content of the fruit is high (30-40%) containing palmitic, stearic, oleic and linoleic acid (Giuseppe Gattuso *et al.,* 2007).

Plant	Uses	Bioactive constituents
Tripahla. The family Triphala consists of *Embilica officinalis* (Amlaki - Family Phyllanthaceae), *Terminalia belerica* (Bahera - Family Combretaceae) and *Terminalia chebula* (Haritaki - Family Combretaceae). 	Tripahla is widely used in the Ayurvedic and Indian traditional medicine systems with benefits of immuno-modulation. *Terminilia chebula* contains Chebulagic acid, Gallic acid and Ellagic acid which make it as a highly potent antioxidant, exhibiting its immuno- modulatory activity. *Terminalia belerica* contains Gallic acid which possess immuno-modulatory activity. Antimicrobial activity is attributed to phenolic compounds and tannins and is useful for curing cough and cold.	*Terminalia belerica* contains 7-hydroxy-3,4-flavone, ethyl gallate, galloyl glucose, Chebulaginic acid, Gallic acid, phenyllemblin, β-sitosterol, anthraquinones, glycosides such as bellaricanin and other carbohydrates. The oil content of the fruit is high (30-40%) as it contains palmitic, stearic, oleic and linoleic acid. *Emblica officinalis* contains phenolic constituents like Gallic acid, Music acid, corillagin, Chebulagic acid, putrajivain A etc. They have high amounts of tannins like emblicanin A and B, punigluconin and pedunculagin, flavonoids like quercetin and alkaloids like phyllantin and phyllantidin, vitamin C, considerable amounts of minerals, proteins and amino acids like proline, alanine, cysteine, glutamic acid, aspartic acid and lysine. The fruits also contain glucose, fibers, phosphorus, iron and calcium. *Terminilia chebula* contains tannins (30-40%; Chebulinic acid, Neochebulinic acid, corilagin, Chebulagic acid, Gallic acid, Elagic acid, punicalagin, terchebin and terflavin A), flavonoids (luteolin, rutins and quercetin) and phytochemicals such as anthraquinones, saponins, β-D-glucogallin, 1, 3, 6-trigalloyl glucose, 1, 2, 3, 4,

Plant	Uses	Bioactive constituents
		6-penta-O-galloyl and various other carbohydrates, amino acids and fatty acids (Pranoti Belapurkar *et al*., 2014).
Ocimum sanctum (Synonym *Ocimum tenuiflorum)* (Common name: Holy basil, Hindi: Tulsi, Kannada: Tulasi, Bengali: Tulsi). It is an aromatic perennial plant belonging to the Family Lamiaceae. It is cultivated throughout the Southeast Asian tropics and is native to the Indian subcontinent. 	*Ocimum sanctum* has been used for its diverse healing properties and immune system. It acts as antiviral agents against viruses because it contain many useful secondary metabolites (such as Urosolic acid, eugenol, apigenin, linalool etc.) The plant has inhibitory effect against the growth of viruses such as Polio virus Type-3, Hepatitis B virus, Infectious pancreatic necrosis virus, Herpes viruses (HSV), Adenoviruses (ADV) and Enterovirus and many more. Leaves are used to get relief from cough, cold, fever and respiratory trouble.	The chemical compound found in Tulsi is in the form of essential oils like β-pinene, Toluene, Citronellal α- Thujene, Octane, Nonane, Benzene, (Z)-3-hexanol, Ethyl 2-methyl butyrate, α-pinene, Urosolic acid, Myrecene, Ethyl benzene, Linalool, Eugenol, Methyl eugenol, β-elemene, (E)-cinnamy, Lactate, Isocaryophyllene, β-caryophyllene, Camphene, Sabinene, Dimethyl benzene Limocene, 1,8,-cineole, Iso-eugenol, α-guaiene, α-amorphene, α-humulene, α - humulene, 4,11-seinadiene cis-β-ocimene, p-cymene, Terpiniolene, Allo-ocimene, Butyl-benzene, α-cubebene, α-terpeneol, Isoborneol, Carvacrol, Borneol, Germacrene-D, α-selinene, β-selinene, Myrtenylformat, á-murolene, Cadinene, δ - Cuparene, Calamene, Geraneol, Nerolidol, Caryophyllene oxide, Iedol, Humulene oxide, (EZ)-famesol, Cis-sesquisainene hydrate α guaiol, τ-cadinol, α-bisbolol, Elemol, Tetradecanal, Selin-11-en-4-α-ol, 14-hydroxy-α-humulene. Leaves contains Gallic acid, Gallic acid methyl ester, β-bisabolene,

Plant	Uses	Bioactive constituents
		Procatechuic acid, Urosolic acid, Luteolin, Apigenin-7-O-glucuronide, Apigenin, Luteolin-7-O-glucuronide, Isorientin, Orientin, Isovitexin, Aesculetin, Aesculin, Chlorgenic acid, Galuteolin, Circineol, Molludistin, Stigmasterol, Triacontanol ferulate, Vicenin-2, Vitexin, Vallinin acid, 4-hydroxybenzoic acid, Caffiec acid, Chlorogenic acid, Phenylpropane glucosides, and β-Stigmasterol. Also contain Vit A and C (Rakesh Kumar Joshi, 2017).
Zingiber officinale (Common name: Ginger, Hindi: Adrak, Kannada: Alla, Bengali: Ada) Ginger belongs to Zingiberaceae Family. It is a flowering plant which is a well-known tropical and sub-tropical shrub. 	The rhizome or root is commonly used as spice and is considered as the most effective natural immuno modulator. The biochemical compound is useful in the management of Hepatitis C virus infection. Dried rhizome is helpful for throat trouble and asthma.	Ginger contains terpenes and oleo-resin, called as Oil of ginger. Dry ginger rhizome consist of volatile oils as Monoterpenoids (β-phellandrene, camphene, cineole, geraniol, curcumene, citral, terphineol, borneol, cineole, geranyl acetate, limonene, linalool) and sesquiterpenoids [α-zingiberene (30–70%), β-sesquiphellandrene (15–20%), β-bisabolene (10–15%), α-farnesene, zingiberol]. Ginger also contain carbohydrates (70%), lipid (8%), fats, waxes, raw fibres, vitamins and minerals(Singh *et al*., 2018).
Cinnamomum zeylanicum (Common name: Cinnamon, Hindi: Dalchini, Kannada: Dalchini, Bengali: Daruchini).	Cinnamon oil or powder have immuno-modulatory effects. The chemical constituent such as cinnamldehyde and eugenol which is found in	The chemical compounds found in Cinnamon species are α-Pinene, Camphene, Benzaldehyde, etc.

Plant	Uses	Bioactive constituents
Cinnamomum verum or Ceylon cinnamon (the source of its Latin name, *zeylanicum*), belongs to the Lauraceae Family. It is a small evergreen tropical tree that originated in Sri Lanka. The tree is one of several *Cinnamomum* species which produce the commercially important spice is known as cinnamon.	barks and leaves posses antimicrobial properties. Cinnamon bark has antiviral inhibitory effects against enveloped viruses such as influenza A, Parainfluenza (Sendai) and HSV-1 viruses.Cinnamon is tradition-ally used since many centuries. Powder is useful to cure cough, influenza and breathing problem. In Ayurveda, inner bark shoot of Cinnamon is used in preparation as flu preventive and for indigestion.	The Cinnamon contains proteins, carbohydrates, vitamins (A, C, K, B3), minerals like Iron, Manganese, Calcium, Magnesium, Phosphorous, Sodium, Zinc, Choline etc. (Sulekha Gotmare and Eshe Tambe, 2019; Meena Vangalapati *et al*., 2012).
Piper nigrum (Common name: Black pepper, Hindi: Kali Mirch, Kannada: Karimenasu, Bengali: Golmorich) Black pepper is a flowering vine in the Family Piperaceae. 	It is known as peppercorn and cultivated for spices and the constituent parts of its essential oil, though tradition-ally used as a fragment aromatic, culinary ingredient, etc. Black pepper have significant anti-viral properties against vesicular stomatitis,Indiana virus and Human para influenza virus. Useful for curing cough, cold and sore throat.	The main chemical compound includes Piperine ($C_{17}H_{19}NO_3$) with the immuno-modulatory and antimicrobial properties (Leila Gorgani, 2006). Piperine contains beta-carotene,Lauric acid, Palmitic acid, and pepper phellandrene. Other essentials compounds such as steroid, alkaloid, flavonoid, phenolics, chalcones and various lignansderivatives are also present in pepper (Zorica Stojanovi´c-Radi´c *et al*., 2019).